

25X1A5a2

SYSTEM 20
TAIL WARNING DEVICE
INSTRUMENTATION
AND
FLIGHT TEST PLAN

8 August 1967
~~7 June 1966~~

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REVISION SHEET

Paragraph Changed

Date

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1. SCOPE

- 1.1. General - The purpose of the System 20 flight test series is to prove performance of that system and to obtain technical data under "near tactical conditions" which may be used to evaluate the performance of the system while operating in a tactical environment. A further purpose of the test series is to demonstrate System 20/System 22 compatibility. In order to obtain useful data from these tests, it is necessary for the test bed to be configured as closely as possible to the operational vehicles.
- 1.2. Test Bed Engine - If the 13B engine is to be used in the future, it is important for it to be configured on the test bed during this test series. Failure to provide such a configuration will require retesting of the System 20 if the 13B engine is configured in the future.

2. TYPES OF TESTS

- 2.1. Background flight tests, including:
 - 2.1.1. Airborne vehicles
 - 2.1.2. Ground sources
 - 2.1.3. Water sources
 - 2.1.4. Solar source
- 2.2. Target detection flight tests, including:
 - 2.2.1. F-104 interceptors
 - 2.2.2. F-106 interceptors
 - 2.2.3. F-4 interceptors
 - 2.2.4. Other available jet aircraft

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3. BACKGROUND FLIGHT TESTS

3.1. Airborne vehicles

3.1.1. Wide range of jet commercial and military aircraft. Afterburning and nonafterburning aircraft are required. During some portions of the test, controlled flight paths of cooperative target aircraft will be required.

3.2. Ground and sea targets

3.2.1. Flights over the ocean, over steel mills, etc., shall be required. The flight over the ocean shall take place in the afternoon or morning so the sun position can produce a worst case specular condition.

3.3. Test duration

3.3.1. Two (2) test bed flights will be required. One (1) back-up flight shall be scheduled and utilized if required.

3.4. Detailed requirements (see Appendix A)

4. TARGET DETECTION FLIGHT TESTS

4.1. General - During this phase of the test effort, the interceptor shall perform intercepts in the manner normally encountered in the field. Other flight patterns are also required.

4.2. Target requirement

4.2.1. F-104

4.2.2. F-106

4.2.3. F-4

4.2.4. Other readily available aircraft

4.3. Test duration

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- 4.3.1. Test flights shall be scheduled on alternate days.
- 4.3.2. Three (3) test bed flights are required. Each mission shall require approximately four (4) hours. One (1) back-up flight shall be scheduled.
- 4.4. Detailed requirements (see Appendix B)
- 5. INSTRUMENTATION
 - 5.1. Test bed instrumentation
 - 5.1.1. Motion picture photography
 - 5.1.1.1. Photography shall be in color.
 - 5.1.1.2. Camera control shall be electrically controllable by System 20 or the pilot.
 - 5.1.1.3. Time recording provision on film is required for data correlation purposes.
 - 5.1.1.4. The field of view shall cover the System 20 envelope (± 40 degrees az., $+15$ through -30 degrees elevation).
 - 5.1.1.5. Frame rate
 - 5.1.1.5.1 A frame rate of one (1) frame per five (5) seconds is suggested during background test flights. During the background test flight series, the camera may be operated continuously.
 - 5.1.1.5.2 A frame rate of one (1) frame per two (2) seconds is suggested during the target detection test flights. Control of the camera will be by the pilot and/or System 20 command.
 - 5.1.1.6. These provisions are required during all test flights.
 - 5.1.2. Voice recording

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- 5.1.2.1. Air/ground/air communications
- 5.1.2.2. Cockpit (pilot) commentary
- 5.1.2.3. Approximately one (1) hour of recording capacity is needed.
- 5.1.2.4. This provision is required during all test flights.
- 5.1.3. Activity light recording
 - 5.1.3.1. General - Recording of light activity can be made by either photographic, strip chart, or magnetic recording. A remote sector light and test light display may be installed in the Q-bay. (Strip chart recording is the most desirable method of instrumentation).
 - 5.1.3.2. Activity signals to be recorded
 - 5.1.3.2.1 Left sector activity indicator
 - 5.1.3.2.2 Center sector activity indicator
 - 5.1.3.2.3 Right sector activity indicator
 - 5.1.3.2.4 Test light
 - 5.1.3.3. Time correlation - Time recording, for purposes of data reduction, is required.
 - 5.1.3.4. The recording device shall be electrically controlled by the pilot and/or System 20 if the recording media is not sufficient to allow for continuous operation over a period of four (4) hours.
 - 5.1.3.5. Approximately two (2) hours recording capacity should be provided.
 - 5.1.3.6. This provision is required during all test flights.
- 5.1.4. Video and pulse recording

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- 5.1.4.1. Recorder bandwidth: 10 Kc
- 5.1.4.2. Number of channels
 - 5.1.4.2.1 Video channels: A quantity of five (5) channels are required.
 - 5.1.4.2.2 Pulse channels: A quantity of three (3) channels are required.
 - 5.1.4.2.3 Time channel: A quantity of one (1) - (Time recording for purposes of data reduction is required).
- 5.1.4.3. The recording media shall, as a minimum, provide for at least four (4) hours of operation.
- 5.1.4.4. This provision is required on all test bed flights.
- 5.1.5. Audio Warning - The test bed pilot shall announce the presence of the audio tone over the radio link.
- 5.1.6. Aircraft Position - During background measurement tests, the pilot shall either log or transmit his position at intervals not to exceed five minutes or when positioned over a target area. (It is assumed that a vectoring facility will not be utilized during the entire background test series).
- 5.1.7. Data reduction - Ground
 - 5.1.7.1. Provisions for playing back magnetic recordings, if utilized for instrumentation of the requirements set forth in paragraph 5.1.3., are required for "quick look" data reduction.
 - 5.1.7.2. Facilities for processing motion picture photography, in a maximum time period of eighteen (18) hours, shall be required.
- 5.1.8. Detailed technical information (see Appendix C and Appendix D).
- 5.2. Vectoring facility instrumentation

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- 5.2.1. Time Correlation: All data shall contain time information having one (1) second resolution.
- 5.2.2. Test bed position (geo)
- 5.2.3. Interceptor(s) position(s) (geo)
- 5.2.4. Range - test bed to interceptor(s)
- 5.2.5. Test bed heading
- 5.2.6. Interceptor(s) heading(s)
- 5.2.7. Test bed speed
- 5.2.8. Interceptor(s) speed(s)
- 5.2.9. Test bed altitude
- 5.2.10. Interceptor(s) altitude(s)
- 5.2.11. Aircraft identification
- 5.2.12. Voice recording
- 5.2.13. Data printout (hard copy) - It is required that hard copy data, specified in paragraph 5.2., be available by 0800 on the day following the test.
- 5.2.14. These provisions are required during all target detection tests.
- 5.3. Special ground instrumentation - During the flight test series, it may be advantageous or necessary to provide voice recording facilities at LAC, Edwards, or the vectoring facility.

APPENDIX A

DETAILED REQUIREMENTS - BACKGROUND

Targets

During the course of the background flight test series, the following types of targets shall be covered as a minimal requirement:

- a. Metropolitan areas
- b. Steel mill(s)
- c. Power generation plants
- d. Refineries or chemical plants which utilize "high stacks" for burn off of gases
- e. Mountainous areas having high, sharp peaks. If the time of year is appropriate, coverage of peaks having snow or ice covering is desirable.
- f. Relatively high altitude areas of water such as mountain lakes
- g. "Bright" desert areas, both high and low altitude
- h. Areas of extended vegetation, such as forests
- i. Areas having high boundary condition (distinct) contrast; i.e., water/vegetation, coast line/shore, contour or irrigation farms, etc.
- j. Extended water areas - the ocean

- k. Direct view of the sun by the system sensor
- l. Specular solar target into the sensor's field of view. This will require the test bed to be positioned over the ocean when the sun's rays will reflect at an angle of less than thirty (30) degrees.
- m. Areas having high concentrations of commercial jet traffic. Both "in route" traffic as well as traffic in landing and take off operations is desirable. (Types of aircraft should be noted if possible).
- n. Target of opportunity areas which could provide bomber or other large military aircraft targets. (Types of aircraft should be noted if possible).
- o. Areas containing extended cloud formations. (Daily liaison with the cognizant meteorological office is required).
- p. Areas containing high altitude cumulus cloud formations. (Daily liaison with the cognizant meteorological office is required).
- q. Other high radiance or reflective man made targets
- r. Other high radiance or reflective natural targets.
- s. Intercept of the above targets at different hours of the day is desirable.

Test Bed

The test bed shall be operated at normal cruise altitude and velocity. A mission duration of approximately four (4) hours at cruise altitude is suggested.

Pilot Participation

The pilot shall cover the target areas as designated in the daily flight test plan. During the course of the test, it is necessary for the pilot to determine his position at intervals of approximately every fifteen (15) minutes as well as to record the time of day he is over designated target areas.

When the test bed has attained cruise altitude, the pilot shall initiate the System 20 self-test to reconfirm its operational status. Self-test should be initiated at intervals of approximately every thirty (30) minutes during the test, but in no event shall he initiate the self-test function while over a designated target area. Self-test shall also be initiated upon completion of the test sequence but prior to descent from cruise altitude.

If targets of opportunity appear during the mission, the pilot should note their characteristics, location, and the time at which they were acquired.

The test bed pilot shall be made aware of the provisions of Appendix E, Security.

APPENDIX B

DETAILED REQUIREMENTS - TARGET

TYPE: NAB-1A

1. Conditions:
 - 1.1 Test Bed
 - 1.1.1 Altitude: approximately 70,000 ft.
 - 1.1.2 Velocity: normal cruise
 - 1.1.3 Course: straight and level
 - 1.2 Interceptor
 - 1.2.1 Altitude: approximately 35,000 ft.
 - 1.2.2 Velocity: cruise
 - 1.2.3 Engine mode: nonafterburning
 - 1.2.4 Initiation of run: approximately 30 miles aft of test bed
 - 1.2.5 Course: identical to, and directly under that of the test bed
 - 1.2.6 Termination of run: may be terminated when interceptor is directly under test bed

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TYPE: NAB-2A

1. Conditions:

1.1 Test Bed

1.1.1 Altitude: approximately 70,000 ft.

1.1.2 Velocity: normal cruise

1.1.3 Course: straight and level

1.2 Interceptor

1.2.1 Altitude: approximately 35,000 ft.

1.2.2 Velocity: cruise

1.2.3 Engine mode: nonafterburning

1.2.4 Initiation of run: directly under test bed

1.2.5 Course: test bed course plus (+) 180 degrees

1.2.6 Termination of run: approximately 30 miles aft of test bed.
Exact termination to be determined during run.

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TYPE: NAB-3A

1. Conditions:

1.1 Test Bed

1.1.1 Altitude: approximately 70,000 ft.

1.1.2 Velocity: normal cruise

1.1.3 Course: straight and level

1.2 Interceptor

1.2.1 Altitude: approximately 35,000 ft.

1.2.2 Velocity: cruise

1.2.3 Engine mode: nonafterburning

1.2.4 Initiation of run: approximately 10 miles aft of test bed
with 10 miles offset

1.2.5 Course: test bed course plus (+) or minus (-) 90 degrees

1.2.6 Termination of run: termination to be determined during
test

TYPE: NAB-4A

1. Conditions:
 - 1.1 Test Bed
 - 1.1.1 Altitude: approximately 70,000 ft.
 - 1.1.2 Velocity: normal cruise
 - 1.1.3 Course: straight and level
 - 1.2 Interceptor
 - 1.2.1 Altitude: approximately 35,000 ft.
 - 1.2.2 Velocity: cruise
 - 1.2.3 Engine mode: nonafterburning
 - 1.2.4 Initiation of run: approximately 30 miles aft of test bed
 - 1.2.5 Course: test bed course plus (+) or minus (-) 15 through 35 degrees
 - 1.2.6 Termination of run: may be terminated when interceptor is directly below test bed

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TYPE: NAB-1B

1. Conditions: Same as for NAB-1A except paragraph 1.2.1 shall read:

"1.2.1 Altitude: approximately 30,000 ft"

TYPE: NAB-2B

1. Conditions: Same as for NAB-2A except paragraph 1.2.1 shall read:

"1.2.1 Altitude: approximately 30,000 ft"

TYPE: NAB-3B

1. Conditions: Same as for NAB-3A except paragraph 1.2.1 shall read:

"1.2.1 Altitude: approximately 30,000 ft"

TYPE: NAB-4B

1. Conditions: Same as for NAB-4A except paragraph 1.2.1 shall read:

"1.2.1 Altitude: approximately 30,000 ft"

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TYPE: AB-1A

1. Conditions:

1.1 Test Bed

1.1.1 Altitude: approximately 70,000 ft.

1.1.2 Velocity: normal cruise

1.1.3 Course: straight and level

1.2 Interceptor

1.2.1 Altitude: approximately 40,000 ft.

1.2.2 Velocity: supersonic

1.2.3 Engine mode: afterburning

1.2.4 Initiation of run: at least 30 miles aft of test bed

1.2.5 Course: identical to and directly under that of test bed

1.2.6 Termination of run: terminate as interceptor passes under test bed

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TYPE: AB-2A

1. Conditions:

1.1 Test Bed

1.1.1 Altitude: approximately 70,000 ft.

1.1.2 Velocity: normal cruise

1.1.3 Course: straight and level

1.2 Interceptor

1.2.1 Altitude: approximately 40,000 ft.

1.2.2 Velocity: supersonic

1.2.3 Engine mode: afterburning

1.2.4 Initiation of run: directly under test bed

1.2.5 Course: test bed course plus (+) 180 degrees

1.2.6 Termination of run: to be determined during run

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TYPE: AB-3A

1. Conditions:

1.1 Test Bed

1.1.1 Altitude: approximately 70,000 ft.

1.1.2 Velocity: normal cruise

1.1.3 Course: straight and level

1.2 Interceptor

1.2.1 Altitude: approximately 40,000 ft.

1.2.2 Velocity: supersonic

1.2.3 Engine mode: afterburning

1.2.4 Initiation of run: approximately 10 miles aft of test bed
with 15 mile offset

1.2.5 Course: test bed course plus (+) or minus (-) 90 degrees

1.2.6 Termination of run: termination to be determined during
test

TYPE: AB-4A

1. Conditions:

1.1 Test Bed

1.1.1 Altitude: approximately 70,000 ft.

1.1.2 Velocity: normal cruise

1.1.3 Course: straight and level

1.2 Interceptor

1.2.1 Altitude: approximately 40,000 ft.

1.2.2 Velocity: supersonic

1.2.3 Engine mode: afterburning

1.2.4 Initiation of run: approximately 30 miles aft of test bed

1.2.5 Course: test bed course plus (+) or minus (-) 15 through 35 degrees

1.2.6 Termination of run: may be terminated as interceptor passes beneath test bed

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TYPE: AB-1B

1. Conditions: Same as for AB-1A except paragraph 1.2.1 shall read:

"1.2.1 Altitude: approximately 50,000 ft"

TYPE: AB-2B

1. Conditions: Same as for AB-2A except paragraph 1.2.1 shall read:

"1.2.1 Altitude: approximately 50,000 ft"

TYPE: AB-3B

1. Conditions: Same as for AB-2A except paragraph 1.2.1 shall read:

"1.2.1 Altitude: approximately 50,000 ft"

TYPE: AB-4B

1. Conditions: Same as for AB-2A except paragraph 1.2.1 shall read:

"1.2.1 Altitude: approximately 50,000 ft"

TYPE: AB-1C

1. Conditions: Same as for AB-1A except paragraph 1.2.1 shall read:

"1.2.1 Altitude: co-altitude with test bed (approximately 70,000 ft.)"

And:

Paragraph 1.2.5 shall read:

"1.2.5 Course: identical to that of test bed"

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And:

Paragraph 1.2.6 shall read:

"1.2.6 Termination of Run: as required by flight safety rules"

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TYPE: INTERCEPT 1

1. Condition:

1.1 Test Bed

1.1.1 Altitude: approximately 70,000 ft.

1.1.2 Velocity: normal cruise

1.1.3 Course: straight and level

1.2 Interceptor

1.2.1 Altitude: commensurate for optimum attack in plus (+)
or minus (-) 40 degrees aft sector of test bed

1.2.2 Velocity: supersonic

1.2.3 Engine mode: afterburning

1.2.4 Initiation of run: as required

1.2.5 Course: power climb in envelop described

1.2.6 Termination of run: as required

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TYPE: INTERCEPT 2

1. Condition:
 - 1.1 Test Bed
 - 1.1.1 Altitude: approximately 70,000 ft.
 - 1.1.2 Velocity: as required
 - 1.1.3 Course: straight and level with maximum evasive turn when interceptor is at approximately 15 miles
 - 1.2 Interceptor
 - 1.2.1 Altitude: commensurate for optimum attack in plus (+) or minus (-) 40 degree aft sector of test bed
 - 1.2.2 Velocity: supersonic
 - 1.2.3 Engine mode: afterburning
 - 1.2.4 Initiation of run: as required
 - 1.2.5 Course: power climb in envelope described
 - 1.2.6 Termination or run: as required

TYPE: INTERCEPT 3

1. Condition:

1.1 Test Bed

1.1.1 Altitude: approximately 70,000 ft.

1.1.2 Velocity: normal cruise

1.1.3 Course: straight and level

1.2 Interceptor

1.2.1 Altitude: "overshoot" to 73 to 75,000 ft. is required

1.2.2 Velocity: supersonic

1.2.3 Engine mode: afterburning

1.2.4 Initiation of run: as required

1.2.5 Course: power climb into plus (+) or minus (-) 40 degrees
aft sector of test bed

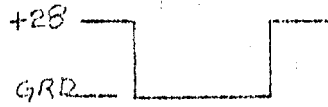
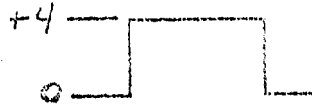
1.2.6 Termination of run: as required

APPENDIX D

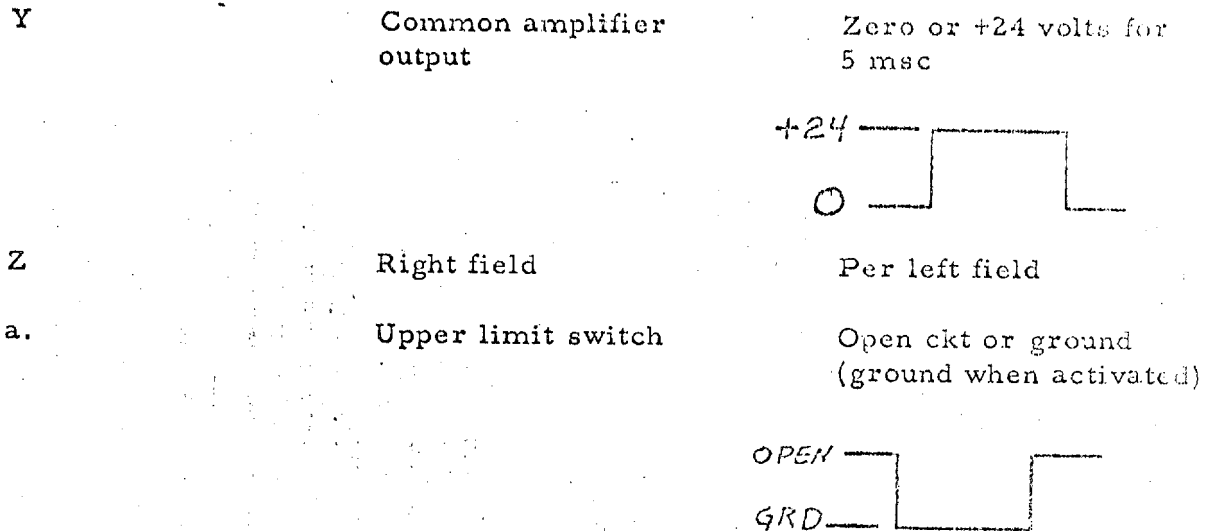
DETAILED TECHNICAL INFORMATION

TEST BED INSTRUMENTATION

1. Interface connector (KPT02A-18-30P), located on pod.
2. The following tabulation identifies those System 20 functions which shall be recorded for test documentation purposes:

<u>Pin</u>	<u>Function</u>	<u>Characteristics</u>
B C	Radiometric Signal return pr #1	Noise level: 1 mv Signal: 9 mv through 1 volt.
E F	Radiometric Signal return pr #2	"
G	Radiometric Signal return pr #3	"
J	Left field	Ground to +28 volts 
K	Center field	"
L M	Radiometric Signal return pr #4	Per pair #1
N	No. 1 bar	Zero or +4 volts open ckt for 278 msec 
R	Radiometric Signal return pr #5	Per pair #1

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Note No. 1 - Relay Contacts

Relay contacts on pins (T, U) and (V, W) are rated at 28 volts - 2 amps.

Note No. 2 - Radiometric Channels

- a. The recorder shall provide 10 Kc response.
- b. Due to the high probability of 400, 800, and 1200 cps "hum" pickup by the instrumentation lines, a balanced transmission line is recommended.
- c. If balanced system cannot be implemented, provisions to include a high pass filter on each of the channels during playback should be provided. Filter should "turn over" at 1.5 to 2 Kc.
- d. An isolation amplifier is required as an interface to the System 20 preamplifier.

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Note No. 3 - Current Capability

The following sources are capable of providing 1 ma. of current, under the conditions specified, to the external instrumentation system:

Left field indicator

Center field indicator

Right field indicator

No. 1 bar

Common amplifier output

For the purpose of determining the input impedance of the instrumentation, approximately 30 K ohm, minimum input impedance, is required.

APPENDIX E

SECURITY

Due to the continued presence of foreign vessels, equipped with electronic intercept equipment, along the coastal areas over which the described flight tests will be conducted, it is recommended that the following measures be implemented as well as other measures which may be required by the cognizant security offices:

a. Furnish information concerning the location of known or potential intercept vessels to the test conductor, the cognizant operations officers, and the cognizant security officers. This information shall be made available to the above personnel at least three (3) days prior to the initiation of the test series and shall be reconfirmed or modified on a daily basis throughout the test series.

b. Prearranged, coded radio transmissions which describe system activity and other critical parameters shall be used in lieu of "plain language" voice transmissions to the maximum extent which is practical.

APPENDIX F
FLIGHT TEST SCHEDULE

<u>Date</u>	<u>Activity</u>
15 Sept 1967	Delivers System
17 Sept 1967	✓ Smoke test (Sunday)
18 Sept 1967	✓ Background tests
18 Sept 1967	Quick look data reduction
19 Sept 1967	x Background tests
20 Sept 1967	Quick look data reduction
21 Sept 1967	x Background tests - backup
22 Sept 1967	Quick look data reduction-backup
25 Sept 1967	x Target detection tests, medium altitude
26 Sept 1967	Quick look data reduction
27 Sept 1967	x Target detection tests, medium to high altitude interceptors
28 Sept 1967	Quick look data reduction
29 Sept 1967	x Target detection tests, high altitude intercepts
30 Sept 1967	Quick look data reduction
2 Oct 1967	x Target detection tests, high altitude intercepts
3 Oct 1967	Quick look data reduction
3 Oct 1967	Test series complete

*Target detection test dates listed herein are tentative.